

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-16. (Cancelled)

17. (Currently Amended) ~~The A control circuit of claim 16 for a fuel cell system having a fuel cell stack and a battery, the control circuit comprising:~~

~~a series pass element electrically coupleable between at least a portion of the fuel cell stack and a portion of the battery; and~~

~~a regulating circuit for linearly regulating current through the series pass element in response to a greater of a battery charging current error, a battery voltage error and a stack current error wherein the regulating circuit comprises:~~

a battery charging current error integrator having a first input coupled to receive a battery charging current signal proportional to a battery charging current, a second input coupled to receive a battery charging current limit signal proportional to a battery charging current limit, and an output to supply a battery charging current error signal proportional to a difference between the battery charging current and the battery charging current limit;

a battery voltage error integrator having a first input coupled to receive a battery voltage signal proportional to a battery voltage, a second input coupled to receive a battery voltage limit signal proportional to a battery voltage limit, and an output to supply a battery voltage error signal proportional to a difference between the battery voltage and the battery voltage limit;

a stack current error integrator having a first input coupled to receive a stack current signal proportional to a stack current, a second input coupled to receive a stack current limit signal proportional to a stack current limit, and an output to supply a stack current error signal proportional to a difference between the stack current and the stack current limit; and

an OR circuit coupled to the output of each of the error integrators to select a greater one of the error signals from the error integrators.

18. (Currently Amended) ~~The A control circuit of claim 16 for a fuel cell system having a fuel cell stack and a battery, the control circuit comprising:~~

~~a series pass element electrically coupleable between at least a portion of the fuel cell stack and a portion of the battery wherein the series pass element comprises a transistor having a first terminal, a second terminal and a control terminal, the first and the second terminals coupleable between the fuel cell stack and the battery; and~~

~~a regulating circuit for linearly regulating current through the series pass element in response to a greater of a battery charging current error, a battery voltage error and a stack current error wherein the regulating circuit comprises:~~

a level shifter coupled to receive the greater of the battery charging current error, the battery voltage error and the stack current error; and

a charge pump coupled to the control terminal of the transistor by way of the level shifter.

19-21. (Canceled)

22. (Currently Amended) ~~The A control circuit of claim 20 for a fuel cell system, comprising:~~

~~a series pass element;~~

~~a blocking diode electrically coupled in series with the series pass element; and~~

~~a regulating circuit coupled to the series pass element to regulate a current through the series pass element in proportion to at least a greater of a difference between a battery charging current and a battery charging current limit, a difference between a battery voltage and a battery voltage limit, and a difference between a stack current and a stack current limit wherein the regulating circuit comprises:~~

a battery current integrator having a first input, a second input and an output, the first input coupled to receive a battery current value and the second input coupled to receive a battery current limit value;

a battery voltage integrator having a first input, a second input and an output, the first input coupled to receive a battery voltage value and the second input coupled to receive a battery voltage limit value;

a stack current integrator having a first input, a second input and an output, the first input coupled to receive a stack current value and the second input coupled to receive a stack current limit value; and

an OR circuit coupled to the output of each of the battery current integrator, the battery voltage integrator and the stack current integrator to select the greater of a value on each of the outputs.

23. (Currently Amended) The A control circuit of claim 20 for a fuel cell system, comprising:

a series pass element;

a blocking diode electrically coupled in series with the series pass element; and

a regulating circuit coupled to the series pass element to regulate a current through the series pass element in proportion to at least a greater of a difference between a battery charging current and a battery charging current limit, a difference between a battery voltage and a battery voltage limit, and a difference between a stack current and a stack current limit wherein the regulating circuit comprises:

a battery current integrator having a first input, a second input and an output, the first input coupled to receive a battery current value and the second input coupled to receive a battery current limit value;

a battery voltage integrator having a first input, a second input and an output, the first input coupled to receive a battery voltage value and the second input coupled to receive a battery voltage limit value;

a stack current integrator having a first input, a second input and an output, the first input coupled to receive a stack current value and the second input coupled to receive a stack current limit value;

an OR circuit coupled to the output of each of the battery current integrator, the battery voltage integrator and the stack current integrator to select the greater of a value on each of the outputs;

a level shifter coupled to the OR circuit to receive the greater of the value on each of the outputs; and

a charge pump coupled to the series pass element through the level shifter.

24. (Canceled)

25. (Original) A control circuit for a fuel cell system, comprising:

a battery charging current sensor;

a battery charging current error integrator having a first input coupled to the battery charging current sensor to receive a battery charging current signal proportional to a battery charging current, a second input coupled to receive a battery charging current limit signal proportional to a battery charging current limit, and an output to supply a battery current error signal proportional to a difference between the battery charging current and the battery charging current limit;

a battery voltage sensor;

a battery voltage error integrator having a first input coupled to the battery voltage sensor to receive a battery voltage signal proportional to a battery voltage, a second input coupled to receive a battery voltage limit signal proportional to a battery voltage limit, and an output to supply a battery voltage error signal proportional to a difference between the battery voltage and the battery voltage limit;

a stack current sensor;

a stack current error integrator having a first input coupled to the stack current sensor to receive a stack current signal proportional to a stack current, a second input coupled to

receive a stack current limit signal proportional to a stack current limit, and an output to supply a stack current error signal proportional to a difference between the stack current and the stack current limit;

an OR circuit coupled to the output of each of the battery current error integrator, the battery voltage error integrator and the stack current error integrator; and

a series pass element having a pair of terminals for selectively providing a current path and a control terminal coupled to the OR circuit for regulating current through the current path in proportion to a greater of the battery current error signal, the battery voltage error signal and the stack current error signal.

26. (Original) The control circuit of claim 25 wherein the regulating circuit comprises a number of discrete integrators.

27. (Original) The control circuit of claim 25 wherein the regulating circuit comprises an analog OR circuit.

28. (Original) The control circuit of claim 25 wherein the regulating circuit comprises a microprocessor.

29. (Original) The control circuit of claim 25, further comprising:
a temperature compensation circuit coupled to the battery temperature sensor to produce a battery voltage limit that is compensated for temperature.

30. (Canceled)

31. (Currently Amended) ~~The A control circuit of claim 30 for a fuel cell system, comprising:~~

integrating means for determining the a difference between the a battery charging current and the a battery charging current limit;

integrating means for determining the-a difference between the-a battery voltage and the-a battery voltage limit; and

integrating means for determining the-a difference between the-a stack current and the-a stack current limit;

means for determining a greater of the difference between the battery charging current and the battery charging current limit, the difference between the battery voltage and the battery voltage limit, and the difference between the stack current and the stack current limit; and

series pass regulating means for regulating a flow of stack current through a blocking diode in proportion to the determined greater difference.

32. (Canceled)

33. (Currently Amended) ~~The-A control circuit of claim 32 for a fuel cell system, further comprising:~~

means for determining a difference between a battery charging current and a battery charging current limit;

means for determining a difference between a battery voltage and a battery voltage limit;

means for determining a difference between a stack current and a stack current limit;

means for selecting the-a greater of the determined differences; and

series pass regulating means for regulating a flow of stack current through a blocking diode in response to the greater of the determined differences.

34. (Currently Amended) ~~The-A control circuit of claim 32 for a fuel cell system, further comprising:~~

means for determining a difference between a battery charging current and a battery charging current limit;

means for determining a difference between a battery voltage and a battery voltage limit;

means for determining a difference between a stack current and a stack current limit;

means for selecting ~~the-a~~ greater of the determined differences;

series pass regulating means for regulating a flow of stack current through a blocking diode in response to the greater of the determined differences; and

means for applying a signal to a control terminal of the series pass regulating means proportional to the greater of the determined differences.

35-51. (Canceled)